

Mark I and Mark II BWRs Containment Venting Systems Guidance for Order EA-13-109 and Accident Management Rulemaking

June 26, 2013



Agenda

- Introductions
- Opening remarks
- Schedules
- NRC presentation – Filtering strategies for BWR Mark I and Mark II containments rulemaking
- NEI/Industry presentation – Filtering strategies for BWR Mark I and Mark II containments rulemaking
- NEI/Industry presentation – Guidance development
- Public questions and comments



Schedule - ISG

- ISG issuance endorsing NEI 13-02 – October 2013
- ACRS Full Committee – October 3, 2013 (Tentative)
- ACRS Sub Committee – Sept. 18, 2013 (Tentative)
- ISG public comment period ends – Sept. 18, 2013
- ISG issued for public comment – August 19, 2013
- ISG draft completion target – August 9, 2013
- Public and industry interactions – June to August 2013



NRC Presentation Filtering Strategies for Mark I and Mark II Containments Rulemaking



Technical Basis Path Forward

- Publish Draft Technical Basis in Federal Register
 - Comment period
- ACRS Interaction
- Information paper due to the Commission in March 2014



Technical Basis Addresses

- Statement of the regulatory problem
- Possible regulatory solutions
- Feasibility of the options
- Proposed rulemaking concepts
- Regulatory analysis
- Backfitting



Technical Basis will Include

- MELCOR/MACCS2
- Event tree and respective probabilities
- Costs of equipment (construction, testing, installation, guidance)
- Accident Analysis Plan
- Backfitting
 - Adequate Protection
 - Cost-justified substantial safety enhancement



Accident Analysis Plan

- Extended loss of AC power
- Severe accident capable vent operational
- FLEX system in place
 - Severe accident functionality
 - Equipment and human reliability
- Consideration of possible outcome
 - Consistent with event tree formulation
 - Informed by Fukushima
- Sensitivities to account for uncertainties



Consideration of Analysis Options

- RCIC operation
 - RCIC duration: 16 hr, 4 hr, 0 hr
 - Flow rate: 600 gpm (or EPG/SAG specification, if any)
- RPV depressurization and vessel injection (?)
 - Reliability of vessel injection under SA condition
 - Injection source, capacity, and effectiveness
- Drywell spray
 - Spray actuation time: @RCIC stop, @ vessel breach, other (?)
 - Spray flow rate: 500 gpm, variation (if any)



Consideration of Analysis Options

- Containment venting
 - Vent sizing: variable between wetwell and drywell, same
 - Vent cycling criteria: (PCPL)/(PCPL-15), other (if any)?
 - Transition from WW to DW venting: SP high water level, other (?)
 - Early venting option: criteria (?)
- Duration of transients: 72 hours, other (?)



Abbreviations

- ACRS – Advisory Committee on Reactor Safeguards
- CER – Cumulative Effects of Regulation
- DW – Drywell
- EPG – Emergency Procedure Guidelines
- GPM – gallons per minute
- PCPL – Primary Containment Pressure Limit
- RCIC – Reactor Core Isolation Cooling
- SA – Severe Accident
- SAG – Severe Accident Guidelines
- SP – Suppression Pool
- WW – Wetwell



Background Slide



Technical Basis to Proposed Rule

- Will use final technical basis to develop proposed rule language and draft guidance
 - Will update regulatory analysis and backfitting for the proposed rule
- Will have public and ACRS interactions between final technical basis and proposed rule



NEI/Industry Presentation Filtering Strategies for Mark I and Mark II Containments Rulemaking



NEI Presentation
Guidance Development
Chapter 6, “Operational Considerations,” NEI 13-02)
(Draft Only)
(ADAMS accession no. ML13176A040)



Questions & Discussion



Next Meetings

- July 9, 2013 – Emergency procedures guidelines (EPGs, Rev. 3), severe accident guidelines, and “early venting” in mitigating procedures.
- July 11, 2013 – Guidance development for Order EA-13-109, and rulemaking activities.





Reference Slides

NRC Slides from June 13th Meeting



Japan Lessons Learned



Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- Order EA-13-109, Reliable severe accident capable hardened vent**

Focus is prevention of core damage as well as capability to vent under severe accident conditions, including those associated with core debris breach of RPV

Phase 1 – Wetwell vent

Phase 2 – Drywell vent or reliable venting strategies that makes it unlikely to venting from drywell would be needed

Industry volunteered to develop a guidance document and Staff agreed to endorse to the extent possible, via an ISG

Immediate attention is on Phase 1. Staff's preference would be to attain as much alignment as possible for staff to endorse Industry guidance with few, if any, of exceptions



**Interim Staff Guidance For Order EA-13-109
Severe Accident Capable vent
Mark I and Mark II Containments**

- **Order EA-12-050, Reliable hardened Containment Vent**
 - Focus is prevention of core damage**
 - ISG issued by staff is a coordinated effort between staff, industry, and input from other stakeholders**
 - Vent from either wetwell or drywell acceptable**
 - Significant number of licensee submittals depicted both a wetwell and drywell vent, however, many licensees stated that drywell vents would not necessarily be in full compliance with the ISG**



Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- ISG and BWROG template for EA-12-050 HCVS is a good starting point for the development of severe accident capable vent**
- Revise guidance and include new guidance as necessary to implement a severe accident vent**



Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- **New or revised requirements**
- **Radiological Conditions**

Routing

Shielding

Relocate vent pipe out of Control Room Envelopes

Affect on accident responders

HCVS control panel locations

Affect on HCVS equipment (Valves/actuators/seals, effluent discharge monitoring, other instrumentation and electrical power supplies, etc.)

Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- **New or revised requirements**
 - **New order requires 24 hours of operation with permanently installed equipment.**
- previous order stated 24 hours in ISG, but also allowed licensee the option of justifying time lower than 24 hours. No such provision will be considered for severe accident vents.**
- BWROG recommended a minimum of 5 valve operating cycles. Need to determine minimum cycles for new order.**
- Issues - Vent cycling as a filtering strategy? When is a vent valve opened, and just as importantly, when is it subsequently closed?**

Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- **New or revised requirements**
 - **Hydrogen – “ensure the flammability limits of gases passing through the system are not reached; otherwise, the system shall be designed to withstand dynamic loading resulting from hydrogen deflagration and detonation”**
- Best option may be to inert the vent line. Line can be continuously inerted or inerting system initiated before venting (N₂ supply continuously aligned for 24 hr supply).**

If designed to withstand dynamic loading from hydrogen deflagration and detonation, should consider the potential for recurrences during multiple venting cycles, a condition that could exist most likely in vent pipe when valve is closed.

Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- **Other Considerations**
- **Schematic drawings submitted in response to Order EA-13-109 indicate for a number of plants, both wetwell and drywell vents. Many licensees indicated that drywell vent would not necessarily be in full compliance with the order.**
- **Phase 1 guidance shall include evaluation of the wetwell and drywell vent configurations for impact on complying with 10 CFR 50.55 requirements of the severe accident capable wetwell vent (e.g. seismic requirements, leak tightness, and any other manner in which it can impact a wetwell vent,) and if required, include appropriate modifications/changes in design.**



Interim Staff Guidance For Order EA-13-100 Severe Accident Capable vent Mark I and Mark II Containments

– Other Considerations

Drawings submitted for order EA-12-050 indicate a variety venting configurations. The submittals appear to be aimed at back-fitting the reliable hardened vent requirements to already existing configurations to the maximum extent possible. While a single configuration is not required by order, the staff believes that a common understanding of how best to achieve venting with minimum reliance on operator actions is desirable.

Interim Staff Guidance For Order EA-13-109 Severe Accident Capable vent Mark I and Mark II Containments

- **Other Considerations**
- **Venting configuration, including venting discharge layout should give consideration for dove tailing the vents to future changes resulting from phase 2 of the vent order and the rule making (e.g. drywell vents, filtering strategies which may require external filters, etc.). Browns Ferry’s submittal for EA-12-050 appear to be taking such things into consideration.**
- **Submittals for EA-12-050 and FLEX mitigating strategies (EA-12-049) are cross referencing each other, which is acceptable, for pre core melt response (both 050 and 049 are pre-core damage). Need to consider the changes required to this approach under severe accident conditions.**
- **Industry did not provide a response to staff’s request for basis (regulatory or otherwise) for early venting to facilitate injection from permanent (RCIC) or portable FLEX equipment. Need to establish the basis and its acceptability for early intentional breaching of containment.**
- **Fault Tree analysis? How is “reliability” verified, understanding single failures are not considered in design.**